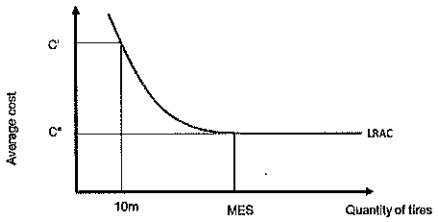
ECO 610 Final Exam
July 2019

Name: KEY
4-digit number: 1234

100 points total. Point values for each question are as indicated. Answer each question in the space provided. General advice: show your work, including any formulas or diagrams that you use in reasoning through your answers.

1. (10 pts.) (a) Draw a graph to explain why might an automobile manufacturer outsource (buy) tires. (b) Use algebra to explain why they might outsource speakers/sound system. (c) Why might a general construction contractor outsource (buy) crane services in carrying out a large construction project like the Gatton building?

- Sometimes there are scale economies in producing an input that would not be exhausted by the firm's usage of the input.



- Sometimes there are economies of scope in producing a set of inputs that would not be exploited by the firm's usage of just one of this set of inputs:

  $C(X, Y) < C(X, 0) + C(0, Y)$, where X=car audio components and Y=other audio products

- Markets can aggregate uncorrelated demands, and thereby take advantage of risk-pooling benefits. Consider a general construction contractor who is building a new business school at the U of KY. At several points along the way during the project, it will need construction crane services. If it owns and operates its own cranes, they will sit idle for extended periods. If it purchases crane services in the marketplace, a dedicated crane supplier can keep its cranes fully employed by moving them from one job site to another when they are needed.

2. (5 pts.) As of June 2019, Google had 92.6% of the search engine market. Bing accounted for 2.5%, Yahoo accounted for 1.8%, Baidu had 1.1%, Yandex RU had 0.5%, and DuckDuck had 0.4%. Compute the HHI for the search engine market and briefly explain the number you get.

$HHI = (92.6)^2 + (2.5)^2 + (1.8)^2 + (1.1)^2 + (0.5)^2 + (0.4)^2 = 8586$

HHI ranges from 0 (atomistic firms, perfect competition) to 10,000 (monopoly). The search engine market is a near-monopoly in structure.

3. (10 pts.) Based on assigned WSJ articles you have read in the second half of the course, briefly discuss the market structure and competitiveness of the markets for (a) small (<100 passengers) regional passenger jets, (b) medium-sized single-aisle passenger jets, and (c) jumbo multi-level passenger jets.

Quotes from assigned articles:

Small regional passenger jets:

Meanwhile, other plane makers, such as Brazil's Embraer SA, have avoided going head-on against Boeing and Airbus and stuck to building smaller airliners.

This year, Boeing challenged Bombardier's sales of a smaller version of the CSeries, the CS100, to Delta Air Lines Inc. at the U.S. International Trade Commission. It accuses the Canadian company of selling the plane below cost. Bombardier dismisses the accusation, saying that new planes are often heavily discounted. It also said that Boeing has no standing to challenge its deal for the 100-seat plane because the U.S. plane maker has no rival product.

Medium-sized single-aisle passenger jets:

Boeing Co. and Airbus SE suddenly have competition. For nearly two decades, the two have had the global market for big commercial jetliners largely to themselves. That is all changing, with three new competitors -- from China, Russia and Canada -- rolling out their own entries into what is called the single-aisle market.

Jumbo multi-level passenger jets:

When Airbus SE launched the A380 superjumbo in 2000, it touted the two-deck plane as "the Eighth Wonder of the World." Instead, the world's largest passenger plane exposed dysfunction inside the European aerospace company and now offers a textbook case of a company misjudging its market and losing big. Steven Udvar-Hazy, a pioneer of aircraft-leasing who was early both to order the A380 and terminate his planned purchase, said the plane was inspired largely by political ambition to outdo Boeing Co.'s 747 jumbo jet as the world's largest airliner.

4. (5 pts.) True or False and explain. You can avoid the interest expense of financing your education through an educational loan if you borrow from yourself, taking money out of personal savings or investment accounts.

False. If you borrow from someone else like a bank, the interest expense on the loan will be an explicit cost. If you borrow from yourself, you will forego the interest earnings from your investments. The interest expense becomes an implicit cost.

5. (10 pts.) Suppose that the 117 existing alligator farmers in the U.S. are able form an agricultural cooperative and effectively monopolize the market for alligator skins and meat. Your boss Ralph wonders what that is going to do to alligator prices in the short run and in the long run. He asks you to conduct a Porter's Five Forces analysis of the alligator market, and then predict and explain the trajectory of prices over the next 5-10 years.

Upstream supplier power: alligator farmers acquire inputs in generally competitive markets. No input suppliers (alligator feed, used school buses, etc.) possess significant market power that would allow them to extract surplus from their downstream customers—alligator farmers.

Downstream buyer power: the customers of alligator farmers are largely companies that buy alligator skins to use in manufacturing products such as handbags, shoes, briefcases, belts, etc. Some of the larger buyers may purchase skins in large enough quantities that they are able to negotiate small discounts. But for the most part, alligator farmers have numerous buyers competing for their skins.

Threat of substitutes: Crocodile skins? Snake skins? Other exotic animal skins? Fashion trends change regularly, and what is the hot style this year can change in short order. So it is not clear that alligator skins are a particularly unique product.

Threat of entry: This is a huge problem for any cartel/cooperative that successfully restricts market output and raises price. The resulting economic profits will attract new firms to enter the market. Since there are no significant barriers to entry into alligator farming, entry will occur. Over time, market output will increase and market price will fall, defeating the cooperative's attempt to monopolize the market.

Internal rivalry: If the cooperative/cartel is able to convince members to cooperate, i.e. each farmer adheres to a production quota, then internal rivalry will be suppressed. While the 117 current alligator farmers collectively have an incentive to cooperate, they each have an incentive to cheat on their quota if the cartel successfully raises market price above the competitive level. If cheating occurs, then output will increase and prices will fall.

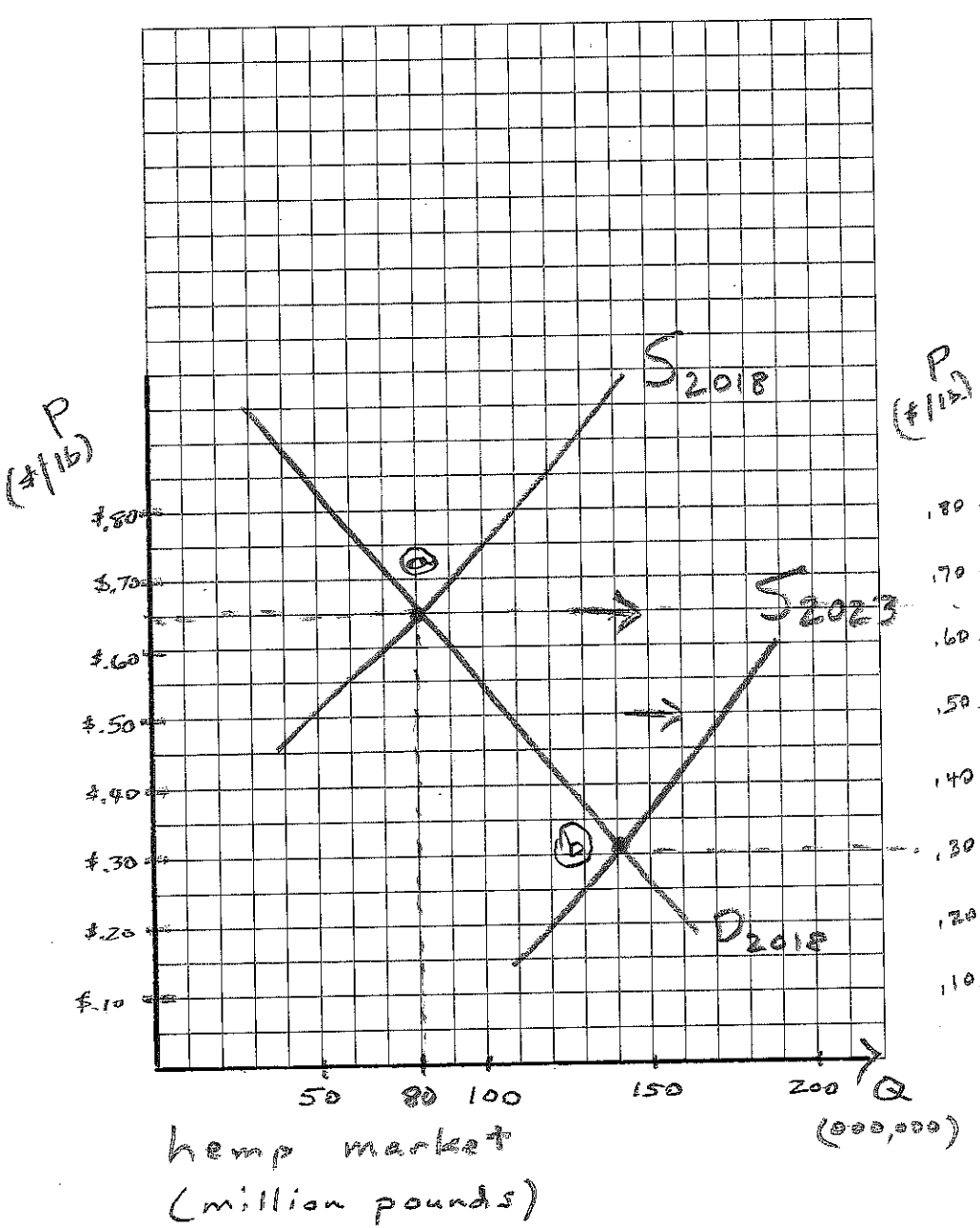
Prediction: The cooperative may be successful in the near term (one or two years) in restricting output and raising price, with ensuing positive economic profits, As time passes, however, entry of new alligator farmers and cheating on production quotas by cooperative members will cause market output to increase and price to fall. In five years prices are likely to have returned to their pre-cartel level.

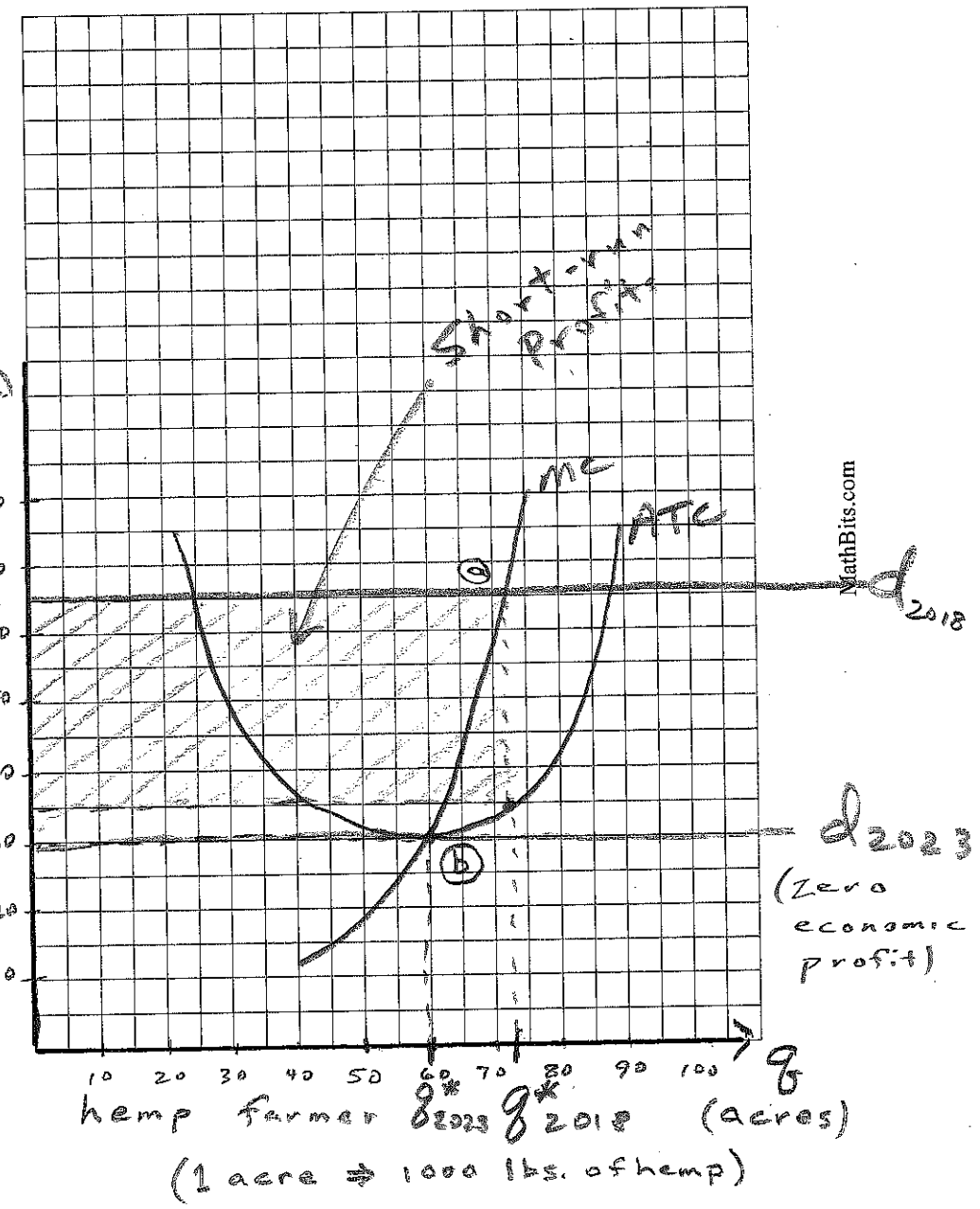
6. (20 pts.) *Lexington Herald-Leader*: "Flourishing hemp industry bringing jobs to Kentucky." *Los Angeles Times*: "As Tobacco Sales Dry Up, Kentucky Farmers Look to State's 'Original Crop'—Hemp."
   Information to use in your analysis: Hemp grain is currently selling for anywhere between $0.60-$0.65 per pound, and on average, hemp farmers get about 1000 lbs. of hemp grain per acre. After taking into account costs, which can range from $300 to $350, farmers can make around $250 to $300 per acre. In 2018 approximately 80,000 acres of hemp were planted in the U.S., i.e. 80 million pounds of hemp were produced. A typical hemp farmer in Kentucky devoted 60 acres to hemp production.
   Now for the question:
   a) In the attached diagrams illustrate the current conditions in the U.S. hemp market and explain briefly how the price of hemp is determined. Also illustrate and explain the situation facing a typical Kentucky hemp farmer. Sketch in the farmer's ATC and MC curves, and show the farmer's optimal output and economic profits.

From the above information, we can infer that market demand and supply intersect at a price between $.60 and $.65 per pound, with equilibrium output being 80 million pounds. That gives rise to the demand facing each firm being perfectly elastic at that market price. We can also infer that a typical firm's average total cost curve bottoms out at a cost per pound between $.30 and $.35 (=$300/1000 lbs.) and output of 60,000 pounds (or 60 acres of hemp). At such an output, and given current market conditions, a hemp farmer can earn between $.25 and $.30 per pound in profit. The market conditions are illustrated in the left-side diagram, and the farmer's demand, cost, and profit position are illustrated in the right-side diagram.

   b) What do you think will happen over time? Do you expect these rosy conditions to last? Illustrate and explain the changes you think will occur over the next five years. What will happen to the price of hemp? The number of hemp farmers? The economic profitability of hemp farming? Illustrate in your diagrams and link your verbal explanation to your diagrams.

Hemp farming is characterized by insignificant barriers to entry. If existing hemp farmers are currently earning positive economic profits, new farmers will enter the market. The market supply curve will shift to the right and market price will fall. Economic profits will decline as a result. In five years, hemp prices will likely fall to a level close to the minimum LRAC of producing hemp. At such a price, farmers will earn zero economic profits, i.e. a normal return. The long-run equilibrium is labeled (b) in each diagram.





7. (15 pts.) The state of Kentucky decides to develop a state park in a fairly remote location in eastern Kentucky, high in the mountains along a river that cuts a deep canyon and has abundant trails and overlooks. They anticipate that lots of outsiders (tourists) will want to visit the park, and some of them may even want to stay overnight. They decide that, rather than the state government owning and operating a hotel/lodge, they will outsource this part of the resort to a private-sector owner-operator. You see an opportunity here, and decide to study demand and costs to determine whether this would be economically profitable. Here is what you discover. Demand is seasonal, with six months on-season and six months off-season. On-season demand is given by $Q = 20 - P$, where Q is the number of rooms demanded per night and P is the price of a room in dollars. Off-season demand is given by $Q = 10 - P$. [Note: the year is 1954, and a dollar would purchase much more in 1954 than in 2019.] Average variable costs, average total costs, and marginal costs are as illustrated in the attached diagram. Now for the question. What price and quantity (number of rooms rented per night) will maximize profits or minimize losses in the off-season? In the on-season? What will daily profits or losses be in each period? Explain how you arrive at your answers, and carefully illustrate in the diagram.

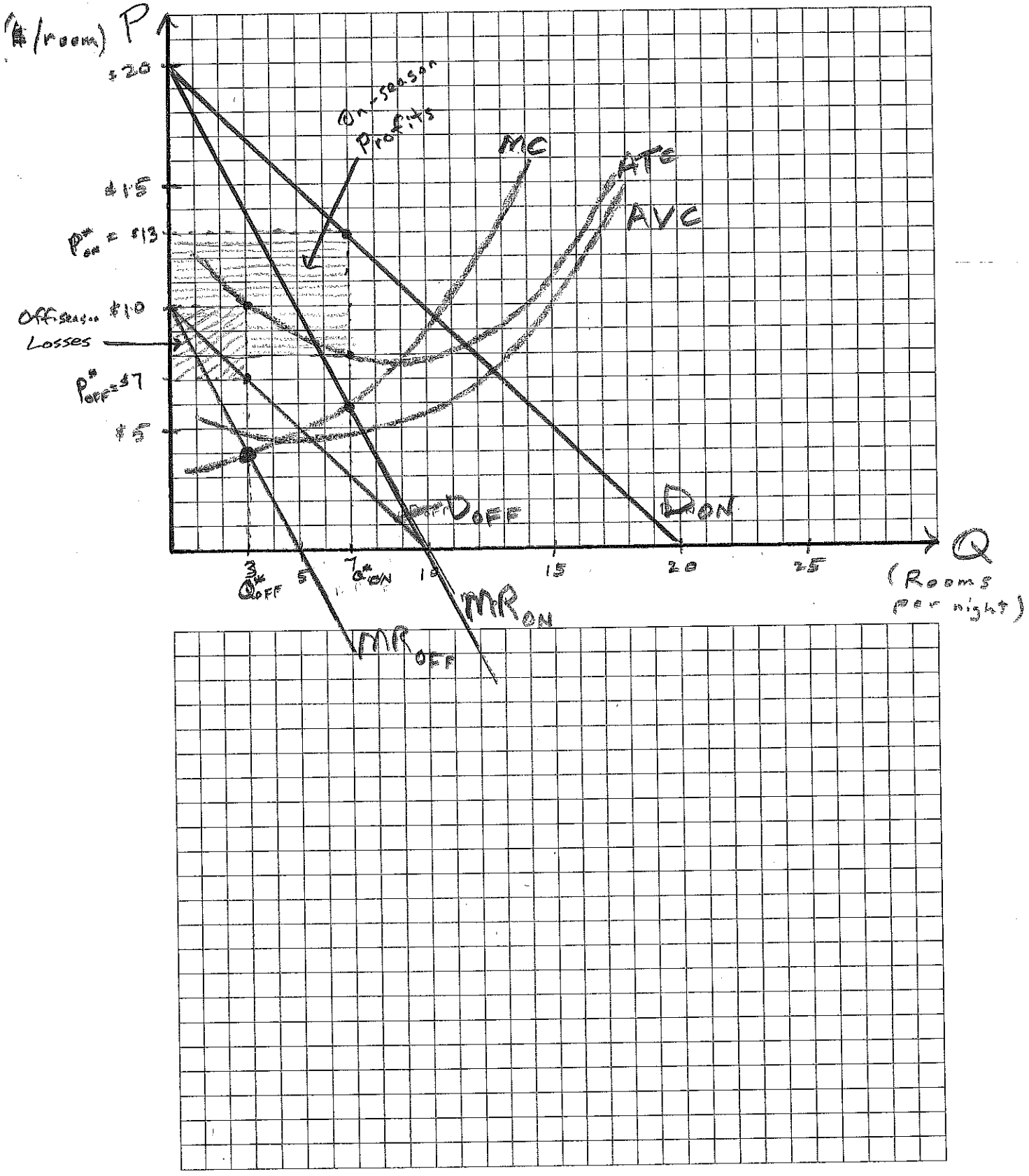
On-season demand and off-season demand are illustrated in the attached diagram. The associated marginal revenue curves are also illustrated. The optimal on-season output occurs at the intersection of the firm's marginal cost curve and the on-season marginal revenue curve (MR = MC). The profit-maximizing price is determined by going up to the on-season demand curve at that output. $Q^* = 7$ and $P^* = \$13$. At that output, average total cost (ATC) equals \$8, so profit per unit is \$5. Total on-season profit equals \$5 x 7, or \$35.

The optimal off-season output occurs at the intersection of the firm's marginal cost curve and the off-season marginal revenue curve (MR = MC). The profit-maximizing price is determined by going up to the off-season demand curve at that output. $Q^* = 3$ and $P^* = \$7$. At that output, average total cost (ATC) equals \$10, so loss per unit is \$3. Total off-season losses equals \$3 x 3, or \$9. Note that price exceeds average variable cost, so the firm is better off producing a positive rate of output than shutting down in the short run.

(5 pts.) Is this an economically viable proposition? If the state decides to auction off the rights to operate this monopoly hotel/lodge to the highest bidder, explain briefly how you would formulate your bid.

Yes. On-season profits more than compensate for off-season losses. Half of the year the firm earns \$35 profit, and the other half it suffers \$9 losses. Average daily profits of \$26 times 365 days per year equals \$9,490 economic profit per year. The market value of being the monopoly provider of overnight lodging in this market is the present discounted value of this future stream of profits. If you bid and secure the rights to this monopoly, you are ahead of the game.

Diagram for Question #7:



8. (10 pts.) The University of Kentucky and the University of Louisville are both considering entering the Executive MBA market. They are the only viable suppliers of EMBA's in the region, and both understand their own and their rival's position in the marketplace. UK can design and put together a program that is high quality, with a commensurate high price, or they can offer a lower quality EMBA that is also lower-priced. UL has a similar strategy choice. They have each independently estimated the economic payoffs to their alternative strategies, given the strategy choice of their rival. Since it takes time to plan curriculum and program delivery, and to recruit and admit students, this market interaction between UK and UL is best evaluated as a simultaneous-move game. The payoff matrix for this game is illustrated below:

		U of L	
U of K		High price, high quality	Low price, low quality
	High price, high quality	**200, 40**	**350, 50**
	Low price, low quality	**280, 100**	**400, 80**

What do you predict will be the outcome of this strategic game? Explain how you arrive at your answer, using solution strategies we discussed in class.

UL's best response to UK's hp/hq strategy is lp/lq. Their best response to UK's lp/lq strategy is hp/hq.

UK's best response to UL's hp/hq strategy is lp/lq. Their best response to UL's lp/lq strategy is lp/lq.

UK has a dominant strategy of low price/low quality. UL, realizing this, will choose high price/high quality. UK's payoff will be 280 and UL's payoff will be 100. This strategy pair is a Nash equilibrium because each university's strategy choice is their best response to the strategy chosen by the other one.

9. (10 pts.) Now suppose that the Gatton College MBA Policy Committee understands the difference between static games and dynamic games, and that they can speed up the development and launch of UK's EMBA program and beat UL to the market, i.e. move first in this game and leave UL to react to their strategy choice. Alternatively, they can drag their feet and let UL be first into the market and then react to UL's strategy choice. What would you recommend that they do? Illustrate your answer by drawing two game trees corresponding to the two different scenarios, and explain what the outcome of each of the games will be.

The game now becomes dynamic, in that UK is able to determine whether they go first or allow UL to go first. Each will look ahead and reason backward, i.e. use backward induction, in deciding on their choice of a strategy. The respective game trees are illustrated below. If UK speeds up and goes first, they will choose hp/hq. UL will then choose lp/lq because that strategy yields a payoff of 50 rather than 40. UK ends up with a payoff of 350. If UK drags its feet and lets UL go first, UL will choose hp/hq. UK will then choose lp/lq, because 280 is preferred to 200. UL will earn a payoff of 100. So UK has an incentive to move quickly and make its strategy choice before UL can get moving, because moving first allows it to achieve a payoff of 350 rather than 280.